

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
10 February 2005 (10.02.2005)

PCT

(10) International Publication Number
WO 2005/012043 A1

(51) International Patent Classification⁷: **B60R 19/02**
(21) International Application Number:
PCT/US2003/039803

(22) International Filing Date:
15 December 2003 (15.12.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/484,712 3 July 2003 (03.07.2003) US

(71) Applicant (for all designated States except US): **NET-SHAPE CORPORATION** [US/US]; 29870 Middlebelt, Farmington Hills, MI 48334 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **EVANS, Darin** [US/US]; 2027 Medina Drive, Wixom, MI 48393 (US). **GUILLES, Melvin** [US/US]; 9511 Lakeshore Drive, West Olive, MI 49460 (US).

(74) Agent: **DOLCE, Marcus, P.**; Price, Heneveld, Cooper, DeWitt & Litton, 695 Kenmoor, S.E., P.O. Box 2567, Grand Rapids, MI 49501-2567 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

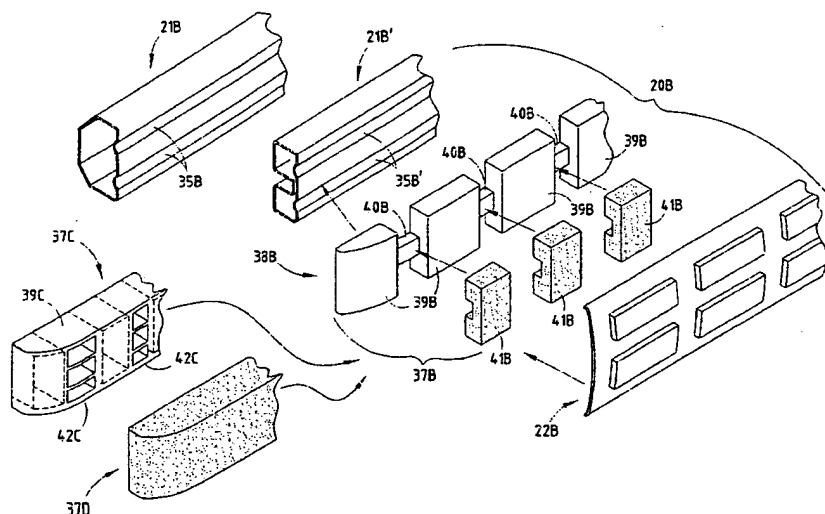
(84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- with amended claims

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **BUMPER SYSTEM INCORPORATING THERMOFORMED ENERGY ABSORBER**



(57) Abstract: A bumper system includes a tubular beam (21) and a thermoformed energy absorber with crush boxes (23) formed into a base flange, such as by vacuum or thermal forming processes. The crush boxes have planar energy-absorbing sidewalls a depth of about 10 mm to 35 mm, wall thickness of about 1 mm to 3 mm, and are formed from polyethylene or other thermoform materials having a memory. The base flange can include thermoformed features engaging recesses in the beam, and is combinable with injection-molded or foam energy absorbers for design flexibility. In one form, the energy absorber includes a thermoformed first sheet forming crush boxes and a second sheet bonded to the first sheet to define apertured air pockets. Related methods of manufacture and impacting are also disclosed.